

PART A. MULTIPLE CHOICE. Circle the letter in front of each correct answer. You do not have to show work. There is no partial credit.

EACH PROBLEM IN THIS SECTION IS WORTH 3 1/3 POINTS FOR A TOTAL OF 50 POINTS.

1. Solve: $x^2 - 5x - 14 < 0$

- a. $-2 < x < 7$ b. $x > 7$ or $x < -2$ c. $x > 7$ d. $x < 7$ e. $x < -9$

2. Given $j(x) = \left(\frac{1}{3}\right)^{2x}$, find $j^{-1}(9)$.

- a. 1 b. -1 c. 2 d. -2 e. none of these

3. Find a best fit line by linear regression for this set of points:

$\{(0, 14), (2, 19), (6, 26), (9, 32), (12, 38)\}$

- a. $y = 3.02x + 12.53$ b. $y = 2.52x + 13.91$ c. $y = 2.04x + 15.02$
d. $y = 1.96x + 14.43$ e. $y = 1.75x + 11.89$

4. The pressure exerted on the floor by a person's shoe heel is directly proportional to one's weight and inversely proportional to the square of the width of the heel. Professor Snarff weighs 200 pounds, wears a shoe with 3 inch wide heel, and exerts a pressure of 24 pounds per square inch (psi) on the floor.

Let P = pressure, L = weight and H = heel width and write an equation expressing pressure in terms of weight and heel width.

a. $P = \frac{533.33H^2}{L}$ b. $P = \frac{0.36L}{H}$ c. $P = 0.133LH$ d. $P = 0.0133LH^2$ e. $P = \frac{1.08L}{H^2}$

5. Given this matrix equation which of the following must be true?

$$\begin{bmatrix} 2 & 5 & 6 \\ 3 & 1 & 4 \end{bmatrix} \begin{bmatrix} 1 & 2 \\ 6 & x \\ 2 & 8 \end{bmatrix} = \begin{bmatrix} 44 & y \\ 17 & z \end{bmatrix}$$

a. $y = 38 + x$ b. $y = 52 + 5x$ c. $y = 36 + 4x$ d. $y = 12 + 3x$ e. none of these

6. Which polynomial does not include $j - 10$ as a factor?

a. $5j^5 - 500j^3$ b. $j^3 + 100j$ c. $j^3 - 100j$ d. $3j^4 - 3000j$ e. $j^2 - 12j + 20$

7. A sum of money is invested at a certain interest rate compounded continuously. After 10.2 years, the investment doubled. At approximately what rate was the money invested?

a. 5.7% b. 6.8% c. 7.6% d. 2.9% e. 4.9%

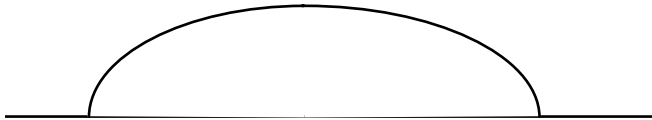
8. Solve for x : $\log_5(5x - 3) = 2.91$.

- a. 22.229 b. 0.716 c. 0.733 d. 1.182 e. 6.702

9. Find the solution set of the given equation. $x^2 + 4x + 7 = 0$

- a) $\{2 + \sqrt{3}, -2 - \sqrt{3}\}$ b) $\{2 + i\sqrt{3}, -2 - i\sqrt{3}\}$ c) $\{-2 + i\sqrt{7}, -2 - i\sqrt{7}\}$
d) $\{-2 - i\sqrt{3}, -2 - i\sqrt{3}\}$ e) none of the above

10. The ceiling of the “whispering gallery” of the Statuary Hall in the United States Capitol Building can be approximated by a semi-ellipse as shown.



Because of the properties of reflection, the whispering of someone standing at one focus can be clearly heard by a person standing at the other focus. Suppose that the distance between the foci is 38.5 feet and the maximum height of the ceiling is 37 feet. Which of the following equations best describes the semi-ellipse?

- a. $\frac{x^2}{1739.6} + \frac{y^2}{1369} = 1$ b. $\frac{x^2}{1482.3} + \frac{y^2}{1369} = 1$ c. $\frac{x^2}{370.6} + \frac{y^2}{1369} = 1$
d. $\frac{x^2}{2851.3} + \frac{y^2}{1369} = 1$ e. $\frac{x^2}{1369} + \frac{y^2}{1369} = 1$

11. How many points (x,y) are solutions of this system?
$$\begin{cases} x^2 - 3y^2 = -11 \\ x - y = -1 \end{cases}$$
- a. 0 b. 1 c. 2 d. 4 e. more than 4

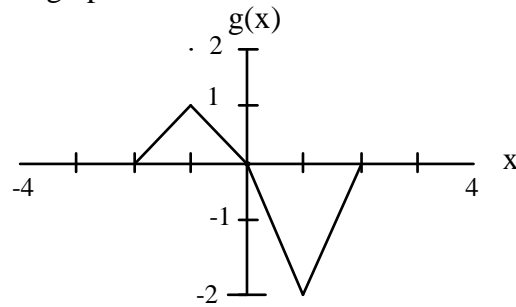
12. How many different 12-member juries can be chosen from a pool of 36 people?
- a. $36 \cdot 12$ b. $\frac{36!}{12!}$ c. $\frac{36!}{24!}$ d. $\frac{36!}{12!24!}$ e. None of the above is correct.
13. $\sum_{k=4}^8 (3k + 5) =$
- a. 30 b. 113 c. 148 d. 115 e. 240
14. When $(5x - 2y)^5$ is multiplied out what is the term containing y^3 ?
- a. $-4x^2y^3$ b. $-32x^2y^3$ c. $-2000x^2y^3$ d. $-120x^2y^3$ e. $-800x^2y^3$
15. Scores on a standardized test are normally distributed with a mean of 500 and a standard deviation of 50. If 10000 of these tests are randomly selected, approximately how many tests would be expected to have a score greater than 600?
- a. about 100 b. between 200 and 250 c. about 500
d. between 700 and 750 e. about 1000

PART B. FREE RESPONSE PROBLEMS. Show your work. Partial credit will be given. 4 PROBLEMS, 5 POINTS EACH, 20 POINTS TOTAL.

16. Here are two functions:

$$f(x) = x^2 + 1$$

$g(x)$ = as graphed below.



a. What is the range of $f(x)$? range _____

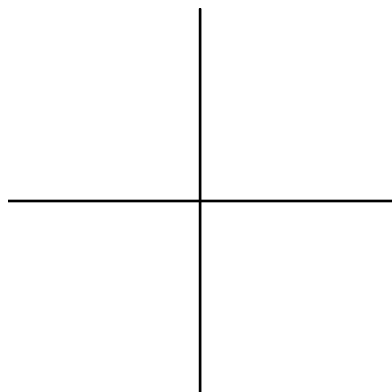
b. Is the inverse of $f(x)$ a function? If it is, write it and if not explain why not?

c. Find $f(g(1))$. $f(g(1)) =$ _____

d. Sketch a graph of $g(x-2)$.

17. a. Write an equation for the inverse function of $f(x) = 2^x$. _____

b. Sketch a graph of $f(x)$ and $f^{-1}(x)$ on the same axes.



18. Solve the given system of equations using a method of your choice. You may use your calculator, provided you briefly explain what you did on the calculator.

$$\begin{aligned}2r + 3s - 5t &= 23 \\4r + s &= 21 \\r - 5s - t &= 2\end{aligned}$$

19. Write a polynomial function, $f(x)$, with the following properties:

$$f(0) = -9;$$

$$f(1) = 0;$$

$$f(3i) = 0;$$

$$f(x) = \underline{\hspace{10cm}}$$

PART C. FREE RESPONSE PROBLEMS. Show your work. Partial credit will be given. 3 PROBLEMS, 10 POINTS EACH, 30 POINTS TOTAL.

20. Given $g(x) = 2x^2 + 12x + 13$.
- Write $g(x)$ in vertex form.

- Give the coordinates of the vertex and the equation of the axis of symmetry.

vertex _____

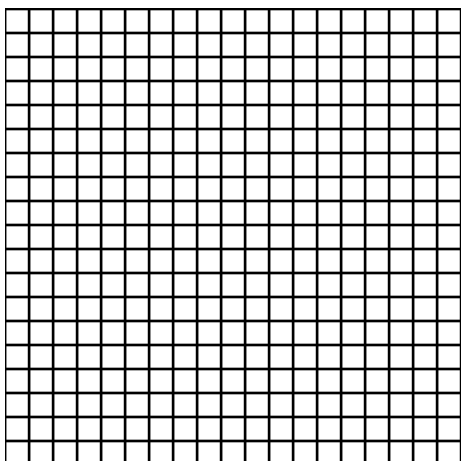
axis of symmetry _____

- Find the coordinates of the focus.

focus _____

21. a. What type of conic is represented by $\frac{(x-2)^2}{16} - \frac{(y+3)^2}{25} = 1$?
- type of conic _____

- Sketch the graph and list the coordinates of whichever of these is appropriate: center, vertices, foci and asymptotes. If any do not apply say "none."



Center _____

Foci _____

Vertices _____

Asymptotes _____

22. The following questions concern a coin that has been bent so that its outcomes are **not fair**: the probability of a head is 55% and the probability of a tail is 45%.

a. Suppose this bent coin is flipped twice. What is the probability that the outcomes of the two flips will be different from each other (i.e., one head and one tail)? Show how you get your answer.

b. How many times in a row would you have to flip this bent coin such that the probability that **all** of the flips are tails would be **less than 1%**? Show how you get your answer.

Again suppose this bent coin is flipped twice.

Let X represent the event that the first flip of the bent coin is a head.

Let Y represent the event that the first flip of the bent coin is a tail.

Let Z represent the event that the second flip of the bent coin is a head.

c. From the events X , Y and Z , choose two events that are *independent*.
Explain why they are independent.

d. From the events X , Y and Z , choose two events that are *mutually exclusive*.
Explain why they are mutually exclusive.